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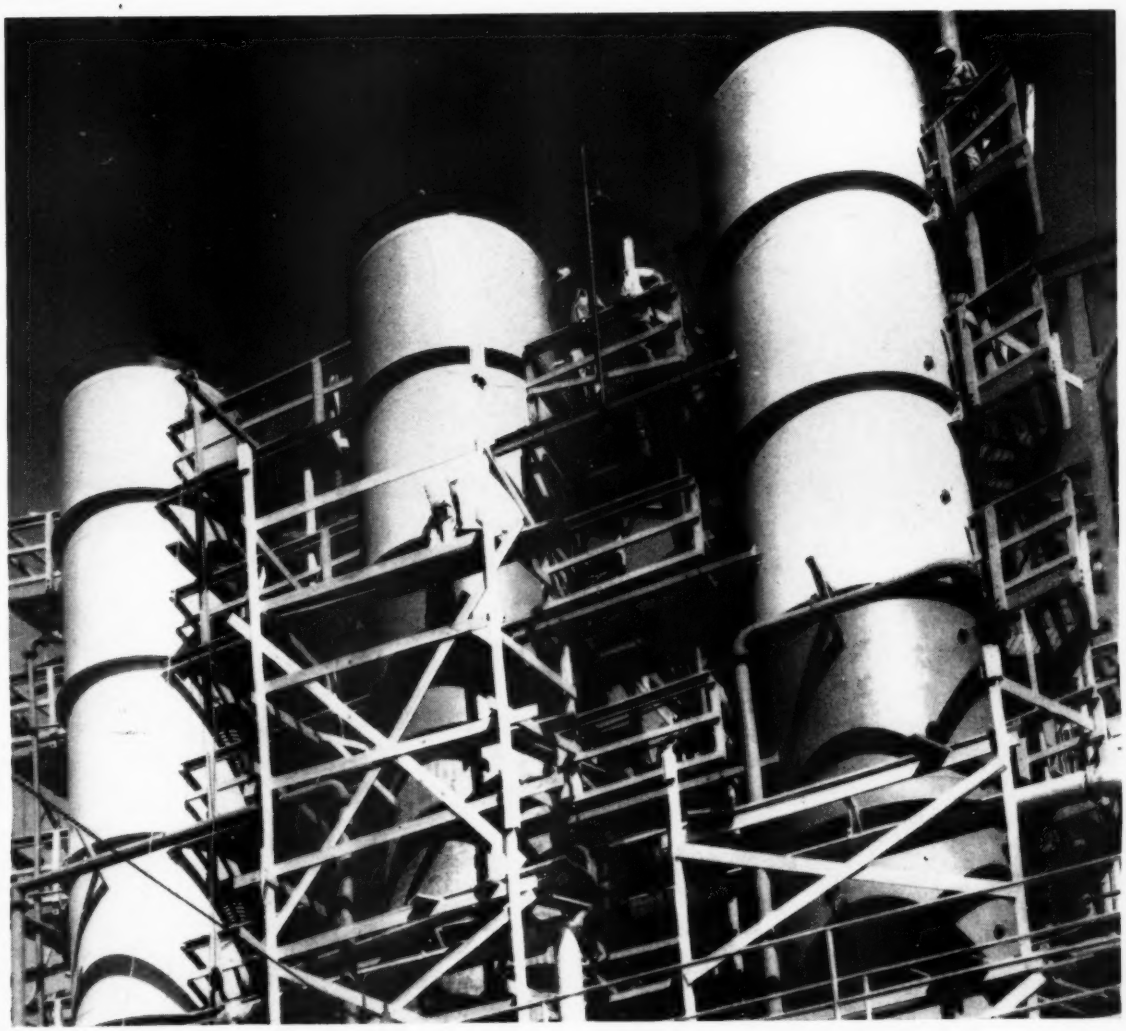

WESTERN SOCIETY OF ENGINEERS FOUNDED 1869

PLASTER CRACKS, BUT WHEN?—PAGE THREE
WSE MEETINGS—PAGE TWO

DECEMBER, 1951

Vol. 4 No. 4

We practice what we preach—
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For many years we have been telling architects, engineers, contractors and others about the advantages of building with architectural concrete. So when we planned buildings of our own—new research laboratories near Chicago—the natural choice was architectural concrete.

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For more information about architectural concrete write for free, illustrated literature. Distributed only in United States and Canada.

Larger of two architectural concrete buildings housing new PCA research and development laboratories is shown at top. Interior of main lobby is pictured above. The two buildings have a combined floor space of about 98,000 sq. ft. and required 7,300 cu. yd. of concrete. All exterior walls are of air-entrained concrete. Oregon fir forms created the board texture. All interior partitions are concrete masonry. The cast stone used in the lobby was made with granite aggregate. Carr & Wright were architects and engineers; The Turner Construction Company was contractor.

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Serving the Engineering Profession

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COVER LEGEND

A view of the government's synthetic rubber plant in Port Neches, Texas, reactivated and modernized for the Office of Rubber Reserve by the Naugatuck Chemical Division of the U. S. Rubber Company. Installation of stainless steel drier fiights was one of the big improvements.

February 4, Communications Developments in Post War Japan

SPONSORED BY COMMUNICATIONS ENGINEERING SECTION

Howard F. Van Zandt, Assistant Sales Manager of the Kellog Switchboard and Supply Company will discuss from his intimate knowledge, the post war developments in Japanese communications with side lights on the political and economic life of the Japanese people. At the request of General MacArthur, Mr. Van Zandt served on the Civil Communications Section of his staff as one of the American telephone executives who directed the rehabilitation of the Japanese telephone and telegraph system.

Since Mr. Van Zandt could speak Japanese fluently he was able to make a very thorough study of the telecommunication problems in all of the 46 prefectures of Japan.

Because of his extensive travels in Japan he became very familiar with both the political and economic life of its people. His added qualifications in this regard are emphasized by the fact that he is the third generation to live in Japan, having resided there for five years after World War I and five years after World War II. Mr. Van Zandt's discussion will be illustrated.

February 6, Wednesday Noon Luncheon Meeting

Speaker will be **Dr. T. L. Tabern,** Abbott Laboratories. His topic will be "New Applications of Radioactivity in Medicine."

February 11,

SPONSORED BY THE CHEMICAL AND METALLURGICAL ENGINEERING SECTION

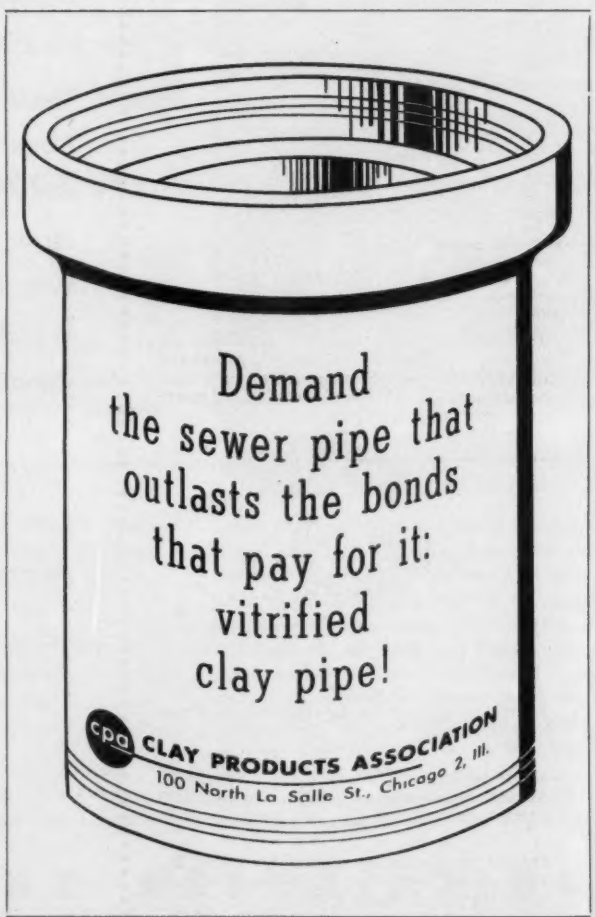
Program to be announced at a future date.

February 25, In What Kind of a City Do I Want to Live

SPONSORED BY THE TRAFFIC ENGINEERING AND CITY PLANNING SECTION

Carl Gardner, Secretary of the Chicago Plan Commission will give a very unusual presentation of Chicago's future needs. A former director of the Commission, Mr. Gardner was elected to his present position last year. Mr. Gardner has done a considerable amount of work in relation to future developments of housing and transportation needs in Chicago.

During his talk, he will use three slide projectors and three screens which will be used simultaneously. This unique presentation was made up by the Chicago Plan Commission for use before civic, business and professional groups to indicate the need for major improvements to make Chicago a better city. The presentation illustrated such features as modernized railroad terminals, superhighways, new civic center, housing and transportation.



PLASTER CRACKS— BUT WHEN?

Third Prize Award
WSE Prize Paper Contest

by ERWIN M. LURIE
Western Society of Engineers

Each year, research and investigation develop countless new formulas correct to the last significant figure and intended to make design and construction techniques more accurate and, therefore, probably more economical. Thus it is extremely rare to find obscure "rule of thumb" empirical formulas still in common use. There is, nevertheless, such a formula; it is in daily use and has been for more than 100 years by almost every engineer and architect in this and many foreign countries. It has been the basis of design of structural elements and members in countless thousands of buildings. It is, in short, the beam-deflection design criterion formula, applicable to plastered construction.

The Beam-Deflection-Design-Criterion for Plastered Construction

Generally stated, this criterion or formula, intended to limit deflection in horizontal supports to which lathing and plastering are to be applied, provides that:

> "Where a plastered ceiling is to be applied under joisted floors or other horizontal structural supports, the structural elements or members to which the ceiling is attached or from which it is suspended shall be of such dimensions and strength and design that they shall not, when supporting the load which they are designed to carry, deflect in excess of an amount equivalent to 1/360th of their span, in order that the plaster shall not crack."

Engineering Design Tables

Every engineer and architect is familiar with the design tables furnished by the fabricators of structural steel. On every page which shows allowable uniform loads will be found a broken black line stepped up or down and a footnote which reads substantially as follows:

> The deflection of floor beams carrying plastered ceilings should be limited to not more than 1/360 of the span length. This limit is indicated in the allowable load tables by horizontal dotted lines; loads below these lines produce greater deflection.

The corresponding tables furnished by manufacturers of structural grade lumber, the stipulations of building codes, government regulations pertaining to building construction, current handbooks and textbooks on architectural and engineering design all follow the same pattern.

What are the principles underlying the "formula?" Who discovered it? Was this formula based on scientific investigation and research, or is it stated as a "rule of thumb?" Why was the formula set at this somewhat odd fraction, and why not lower or higher?

In an effort to learn who had discovered the principles underlying the formula, the Metal Lath Manufacturers Association, some time prior to 1940, having exhausted its own sources of information, made inquiry of leading scientific authorities in architectural and engineering colleges and engineering experiment stations. Other than having "seen it in Kidder or somewhere" those questioned had no knowledge of its origin.

A similar dearth of information was revealed when seeking answers as to whether anyone had actually tested floor assemblies, with plastered ceilings below, and why it had been set at 1/360 x span, and no more and no less.

Observing that answers to these questions, as well as to other problems relating to lathing and plastering would be of interest to the entire building industry, and particularly to contractors and journeymen engaged in lathing and plastering, the Office of Technical Services of the Department of Commerce, early in 1947, engaged the services of the Armour Research Foundation to undertake a research project on lathing and plastering practices. High among its objectives was to be an investigation of the origin and an evaluation of the sound-

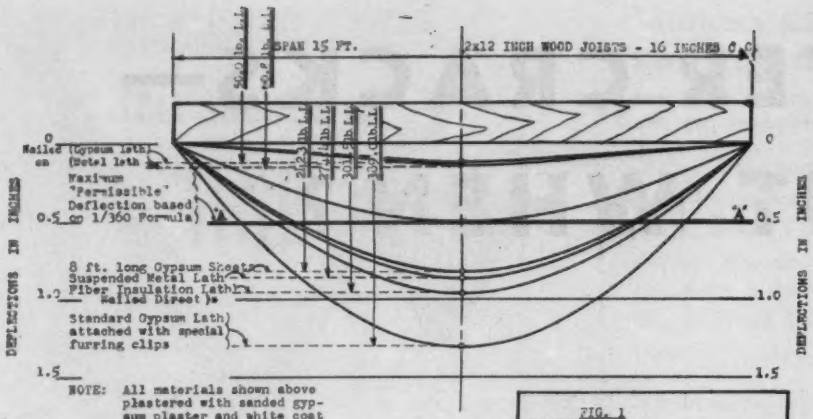

SPAN 15 FT.
2x12 INCH WOOD JOISTS - 16 INCHES C.C.
50.0 Lb. L.L.
40.0 Lb. L.L.
Nailed (Gypsum lath) on (Metal lath
Maximum "Permissible" Deflection based on 1/360 Formula)
8 ft. long Gypsum Sheets Suspended Metal Lath Fiber Insulation Lath Nailed Direct
Standard Gypsum Lath attached with special furring clips
DEFLECTIONS IN INCHES
NOTE: All materials shown above plastered with sanded gypsum plaster and white coat finish.

FIG. 1
PLASTER DEFLECTION AND CORRESPONDING LIVE LOADS AT TIME OF PLASTER FAILURE OF 2 x 12 INCH WOOD JOISTS CARRYING DIRECTLY NAILED, FURRED AND SUSPENDED PLASTERED CEILINGS, SPACING ALSO 1/360 x SPAN (Loads are in pounds per sq. ft.)

ness of the beam-deflection design criterion formula as applied to plastered construction.

The results of this investigation, which are stimulating and revealing are contained in the Department of Commerce voluminous report: "Standard Lathing and Plastering Practices" issued December 28, 1948. It is, in fact, so voluminous, and the information on the particular points to be considered in the present article so buried in a vast amount of detail that much of the significance of the results of the investigation on the deflection formula has been all but obscured. Furthermore, the intended scope of the research project did not contemplate more than a brief referral to the application of the findings to actual building design. This article has, accordingly, been prepared to bring the facts to light, show how they may serve a very useful purpose.

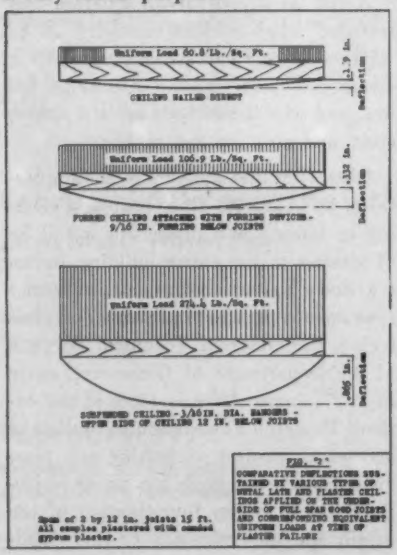

Uniform Load 50.8 Lb./Sq. Ft.
CEILING NAILED DIRECT
Deflection
Uniform Load 100.9 Lb./Sq. Ft.
FURRED CEILING ATTACHED WITH FURRING DEVICES - 9/16 IN. FURRING BELOW JOISTS
Uniform Load 274.4 Lb./Sq. Ft.
SUSPENDED CEILING - 3/16 IN. DIA. HANGERS - UPPER SIDE OF CEILING 12 IN. BELOW JOISTS
Span of 2 by 12 in. joists 15 ft. All samples plastered with sanded gypsum plaster.

FIG. 2
COMPARATIVE DEFLECTIONS OBTAINED BY VARIOUS TYPES OF METAL LATH AND PLASTER CEILINGS APPLIED ON THE UNDERSIDE OF FULL SPAN WOOD JOISTS AND CORRESPONDING EQUIVALENT UNIFORM LOADS AT TIME OF PLASTER FAILURE

How the Formula Originated

After a long and thorough search of engineering and architectural literature, the Armour research organization came up with the apparent answer to the question as to the origin of the formula:

It seems that along about the year 1828, according to Frank Kidder, (1859-1905) a well-known authority on the subject of architectural engineering, Thomas Tredgold, an early British engineer, and contemporary authorities were of the opinion, "that if a floor-beam deflects more than one-fortieth of an inch for every foot of span it is liable to crack the ceiling on the other side, and hence this is the limit which is generally given to the deflection of beams in first class buildings."

Presumably, for lack of better authority, the design of buildings in Tredgold's time and for a considerable period thereafter was based on this rule. However, Kidder observed, in his "Architects and Builders Pocket Book," (12th edition 1895), that, "many engineers and architects think that one-thirtieth of an inch per foot of span is not too much to allow for the deflection of floor beams, as a floor is seldom subjected to its full estimated load, and then only for a short time."

Kidder's proposed one-thirtieth of an inch was translated into the now well-known 1/360 x span formula; it superseded Tredgold's 1/480 x span, and, because of the authority and influence wielded by Kidder, through his "Pocketbook" and other important literature, became the engineering-design law of the land.

Nowhere were the Armour Research people able to unearth any published comprehensive data, however, which would prove that the criterion had ever been verified by laboratory test. Furthermore, considering the period when it was first proposed by Tredgold, and its subsequent modification by Kidder, it was doubtless contemporary with wooden beam and girder construction, and wood lath as the plaster base. During the many years following, use of structural steel and reinforced concrete had been developed and increased so as to equal and, for many purposes, supplant wood as the principal materials for horizontal structural supports in buildings.

Also, metal lath and gypsum lath, both unknown in 1828 and comparatively new even in Kidder's time had almost completely displaced wood lath. Further, in large structures metal lath was not generally being attached directly to structural supports by nails, but was secured by wire ties to small ¾-inch light steel furring channels which in turn were supported by wire hangers from steel and concrete structural members.

The Test Program

To test the validity of the deflection formula, an extensive series of full-size samples were constructed and tested at the Armour Research Foundation Laboratories. Most of the spans were 15 feet; some were 18 feet long. It was de-

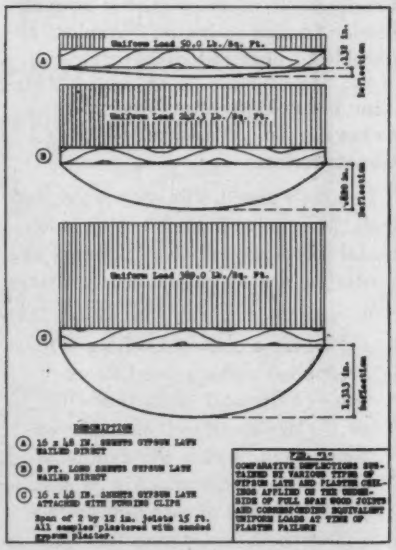

Uniform Load 50.0 Lb./Sq. Ft.
Deflection
DESCRIPTION
A 16 x 16 IN. SHEETS GYPSUM LATH NAILED DIRECT
B 8 FT. LONG SHEETS GYPSUM LATH NAILED DIRECT
C 16 x 16 IN. SHEETS GYPSUM LATH ATTACHED WITH FURRING CLIPS
Span of 2 by 12 in. joists 15 ft. All samples plastered with sanded gypsum plaster.

FIG. 3
COMPARATIVE DEFLECTIONS OBTAINED BY VARIOUS TYPES OF GYPSUM LATH AND PLASTER CEILINGS APPLIED ON THE UNDERSIDE OF FULL SPAN WOOD JOISTS AND CORRESPONDING EQUIVALENT UNIFORM LOADS AT TIME OF PLASTER FAILURE

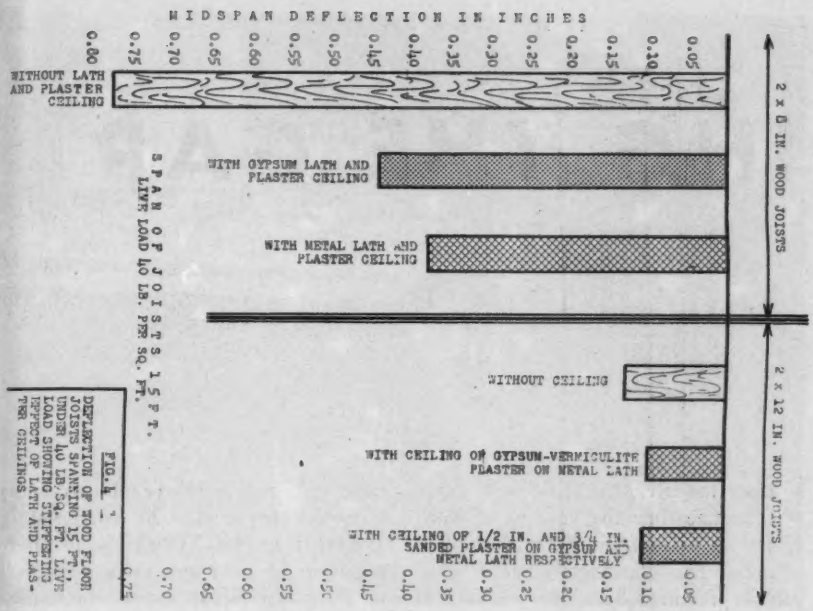

MIDSPAN DEFLECTION IN INCHES
0.80 0.75 0.70 0.65 0.60 0.55 0.50 0.45 0.40 0.35 0.30 0.25 0.20 0.15 0.10 0.05
WITHOUT LATH AND PLASTER CEILING
WITH GYPSUM LATH AND PLASTER CEILING
WITH METAL LATH AND PLASTER CEILING
2 x 8 IN. WOOD JOISTS
SPAN OF JOISTS 15 FT.
LIVE LOAD 40 LB. PER SQ. FT.
WITHOUT CEILING
WITH CEILING OF GYPSUM-VERMICULITE PLASTER ON METAL LATH
WITH CEILING OF 1/2 IN. AND 3/4 IN. SANDED PLASTER ON GYPSUM AND METAL LATH RESPECTIVELY
2 x 12 IN. WOOD JOISTS

FIG. 1 - DEFLECTION OF WOOD FLOOR JOISTS SPANNING 15 FT., UNDER 40 LB. SQ. FT. LIVE LOAD SHOWING STIFFENING EFFECT OF LATH AND PLASTER CEILINGS

cided, as the result of preliminary experiment and analysis, that the relationships between span length, deflection, and plaster cracking would be comparable whether wood or steel were used as the structural supports for the lath and plaster. Because wood simplified many of the problems of assembly, however, and because it was desirable to relate the results of present lath and plaster assemblies to those which prevailed 100 years ago or more, wood joists were used as the structural supports for the basic determinations. The lath and plaster assemblies were secured to these by direct nailing to the underside of the joists, by use of furring devices, and by suspension, using standard details for metal lath and plaster suspended ceilings.

To eliminate a variable which might enter into actual deflection under load, both rough and finished wood flooring, commonly used in joisted construction was omitted. Another variable whose possible effect was eliminated was cross bridging. In its place a form of horizontal pipe separator was used insuring that all members in each floor panel would respond uniformly under load. Panels were of the spans already mentioned and were 4 feet wide. Some were constructed of 2 x 8 inch joists, but the majority of the panels were built with 2 x 12 joists. In all cases joists were spaced 16 inches on centers.

Loading was by means of hydraulic rams placed on steel loading beams, transverse to and located on the upper side of the joists at their quarter points. Deflection readings, taken on the underside of the plaster ceilings were read to thousandths of an inch using dial gauges. The deflection of the plaster surface and indirectly that of the joists was measured. Loading was continuous until plaster failure occurred in the form of a crack. In many cases these were invisible unless the surface was wetted, and closed up when the load was removed. Occurrence of the crack could be heard, however, even when the crack was not readily visible. Until some better method of determining the end point in tests of brittle material such as plaster, is devised, incidence of the first crack will probably have to be considered the determinant.

Results of Tests

Samples of wood, gypsum and metal lath and plaster consistently cracked at deflections far less than 1/360 x span, when joists were 2 x 12 inches. In fact, values attained were only ¼ to ⅓ of "allowable." These values are shown graphically, but not to scale, in the upper two curves of Figure 1. They may be compared to the line "A-A" which represents 1/360 x span, and is one-half inch. The same results are shown at the top of Figures 2 and 3, in the ceiling-nailed-direct diagrams for metal lath and gypsum lath respectively. In a large majority of the wood lath, gypsum lath and metal lath samples attached to 2 x 8 joists, the plaster cracked at deflections considerably less than the allowable.

The foregoing results, therefore, run quite contrary to the natural assumption that, if deflections are kept well below the allowable, the plaster will not crack. Furthermore, the formula makes no allowance for the effect of the thickness of the plaster on the cracking. How important this latter factor is, is shown in Figure 5.

On the other hand, the substantial stiffening effect on floor systems, of metal lath or gypsum lath and plaster

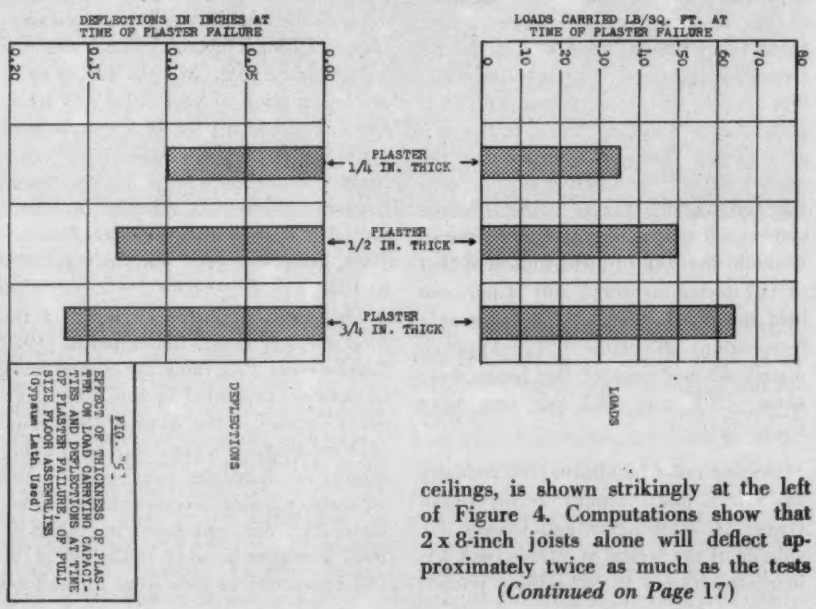

DEFLECTIONS IN INCHES AT TIME OF PLASTER FAILURE
0.20 0.15 0.10 0.05 0.00
LOADS CARRIED LB/SQ. FT. AT TIME OF PLASTER FAILURE
0 10 20 30 40 50 60 70 80
PLASTER 1/4 IN. THICK
PLASTER 1/2 IN. THICK
PLASTER 3/4 IN. THICK
DEFLECTIONS
LOADS

FIG. 5 - EFFECT OF THICKNESS OF PLASTER ON LOAD CARRYING CAPACITY AND DEFLECTION OF FULL SIZE FLOOR ASSEMBLIES (Gypsum Lath Used)

ceilings, is shown strikingly at the left of Figure 4. Computations show that 2 x 8-inch joists alone will deflect approximately twice as much as the tests

(*Continued on Page* 17)

BRIDGING THE GAP

by W. E. HELIN
Plant Division Manager
Pictsweet Foods, Inc.

The freezing of vegetables and fruits is often considered as a new industry. The first patent related to freezing, however, was issued to H. Benjamin in 1842. This patent covered "freezing by immersion" and pertained to the freezing of fish. The industry's big boost came in the 1880's when the ammonia mechanical refrigeration system was developed. The lack of refrigerated warehouses, inadequate refrigerated transportation and lagging knowledge and interest in frozen food technology, however, were factors contributing to the slow development of the industry. We still are lagging in proper warehousing of frozen foods with regards to sufficient space and adequate temperature. The industry also is faced with a shortage of acceptable refrigerated railroad cars for cross country shipments. Refrigerated cars often reach temperatures exceeding 20°F and recording thermometers have indicated that temperatures even in excess of 32°F occur during shipment, much to the chagrin of processors who desire that the quality strived for so diligently in packing and freezing plants reach the consumers. Tests made of store freezer boxes in the Fall of 1946 indicated that of 187 boxes inspected only 8 per cent held the retail consumer packages at a temperature of below 0°F. Approximately 47 per cent of the boxes were above 15°F and 14.5 per cent were above 25°F.

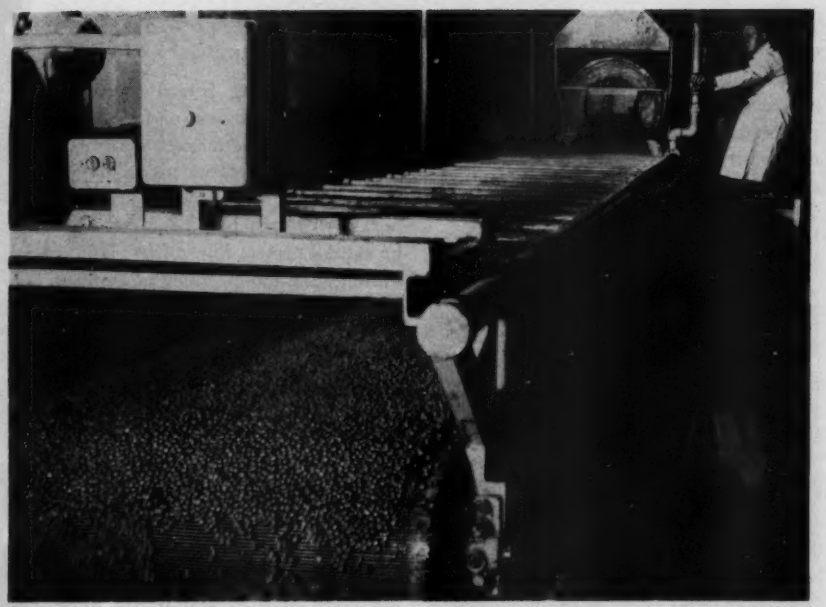
Despite these handicaps, the industry has grown phenomenally during recent years. In Washington and Oregon the volume of the frozen vegetable pack has increased from 7 to 162 million pounds between the period of 1935 and 1948; at the same time the volume of fruits frozen increased from 50 to 125 million pounds. The Washington and Oregon pack represented 35 to 40 per cent of the nation's pack in 1948 as reported in "Summary of Pacific Northwest Industries" by the Seattle First National Bank, March, 1949. The national pack of frozen foods as reported by the U. S. Census Bureau has increased from 3 million pounds of vegetables and 65 million pounds of fruit in 1934, to 415 million pounds of vegetables and 447 million pounds of fruit in 1948.

Consumer-wise, independent consumer surveys (*Women's Home Companion*) reveal that 76 per cent of the women buy frozen foods and 64 per cent serve frozen foods one to seven times a week. Just prior to the war the per capita consumption of frozen vegetables and fruits was 1.2 pounds a year. In 1948 the per capita consumption of vegetables and fruits had jumped to 6 pounds a year, with a consumption of 1.8 pounds of other frozen foods such as fish, prepared products and meats. As a result, where only 532 stores handled frozen foods in 1934, 169,000 stores sold frozen foods in 1948.

The position of the engineer in the food industry is well illustrated in "1949 Employment Programs for Engineering Graduates" presented by the Joint Engineers Council in the August, 1949 issue of *Mechanical Engineering*. Twenty groups of industries consisting of 162 separate organizations reported that they hired 25.8 per cent fewer engineers in 1949 than they hired in 1948; but of the 162 organizations nine were in the food industry group, and these nine industries hired 5.9 per cent more engineers in 1949 than in 1948. This trend for more engineers in food industries is necessitated by the demand for lower food prices with a sustentation of food quality. Since farm prices have not dropped appreciably and since the cost of labor is continuing to rise, the only method of reducing prices is by the reduction costs accomplished by increased productivi y and more efficient plant operation. By virtue of his training and experience, the engineer becomes a natural cost reduction tool of management.

The refrigeration engineer occupies a significant position in the freezing industry, and he is a tool of effective management. While the technical skill required of a refrigeration engineer is not necessarily as broad as that of chemical engineer who is concerned primarily with research in processing methods or a food technologist whose duties are related to product control during processing, he is, however, required to be well versed in the fundamentals of heat transfer, fluid flow, thermodynamics and psychrometry.

Many problems of the refrigeration engineering field in the frozen food industry must be solved from basic data, and it is more often true than not, that handbook and data book information are not applicable to specific problems. While "rules of thumb" and general formulas are keys which open the doors of solution to problems, it is often that the key must be forced into the keyhole and wiggled considerably until the right tumblers are raised; and thorough



ADIABATIC COOLING—Atomized water and evaporation removing sensible heat from warm peas prior to quality grading.

grounding in theory will result in the ability to design the right key to each lock—each problem. This basic theory is the tool of the refrigeration engineer which enables him to "bridge the gap" for management and for the operating engineer. Without a thorough grounding in theory he can not accurately answer management's questions or solve its problems.

Management in industry has been defined as the art of getting investors and workers to understand each other and to work together for their common good. Management obtains the money required to operate a business and then sees to it that in addition to supplying jobs for workers, the investor receives a fair profit for his risk. The judicious expenditure of funds is necessary by management if a company is to operate and show a profit. It is a responsibility of the refrigeration engineer to advise management in the investment of money when refrigeration equipment is considered. To accomplish this end the refrigeration engineer in the frozen foods industry needs to be cognizant of problems related to farming activities, processing procedures, warehousing methods, and transportation of the finished product.

Farming activities seem unrelated to refrigeration at first glance. When a frozen food plant is designed, however, a capacity figure must be utilized to select refrigeration equipment. If the capacity is based on available data, acreage knowledge of yields per acre is a prerequisite. Also harvesting schedules must be known for most products have a peak harvest period. Strawberries, as an example, while harvested in a normal 25 day period, peak to the extent that 60 per cent of the total yield will be picked in a 10 day period. Therefore plant freezing capacity must not be based on 4 per cent of total pack to be frozen per day, but 6 per cent, an increase of 50 per cent in freezing capacity. There are peaks to contend with in every product packed, and these peaks must be given proper and weighted consideration by the designer of the refrigeration system.

Processing procedures must be thoroughly digested in order to estimate capacity of refrigeration required. Recovery of freezable food from gross farm receipts will vary from as little as 23 per cent from corn when frozen in kernel, to as high as 115 per cent from berries to which sugar syrup is added. These recovery factors affect design and equipment selections, for if they are estimated at too high a value excessive capital investment is required by the processor. If recovery is estimated too low, then the processor will have to search for outside freezing services usually during a period when little, if any, are available. In addition, vegetables are blanched prior to freezing. The efficiency of cooling after blanching affects the temperature of the product going into the freezer. Often a simple and inexpensive method of removing sensible heat after blanching and prior to freezing will result in a lower investment in freezing equipment. Also the materials used for freezing trays can amount to an appreciable reduction in design capacity. A steel freezing tray weighing 35 pounds presents a cooling load of approximately

QUALITY GRADING PEAS—Prior to freezing the tenderest peas are separated by floatation in brine. The age old principle of Aristotle is again put to use of modern science of food preservation.

440 BTU, whereas an aluminum tray of equal size, weighing 10 pounds, cooled from 70°F to 0°F represents a load of only 158 BTU. Based on 27 pounds of product in a tray, and a tunnel with a 3.0 tons per hour capacity, the use of aluminum trays would reduce the refrigeration load by approximately 73,800 BTU per hour or 6.15 tons of refrigeration. This might well be the difference of nearly five thousand dollars in capital investment, excluding higher operating costs. The 6.15 tons of refrigeration saved in using aluminum trays represents approximately 8.7 per cent of the refrigeration load of freezing 3 tons of lima beans per hour from 65 degrees to 0 degrees.

Freezing time also is a factor of importance, for normally the shorter the freezing time the smaller will be the space requirements in the processing plant for the freezing equipment. The use of the belt freezer for loose freezing products such as peas, lima beans and cut corn will allow freezing of the product in approximately 15 to 20 minutes, whereas a tunnel and buggy system requires approximately 3 hours at -30° with air velocities of 1,200-1,500 feet per minute if the product is in a package. There is a loss in recovery due to dehydration in the belt tunnel as no vapor resistant packaging material surrounds the product. However, this has been found to be only 2.5 per cent by weight by actual experiment. The elimination of the cost and maintenance of buggies and trays, and the elimination of the labor of placing packages in trays and loading and unloading the tunnels with buggies more than offsets the loss in recovery. A tray and buggy pea freezing operation requires approximately 1.97 manhours of direct labor per 100 pounds of frozen product while a belt freezing operation requires only 0.78 manhours per 100 pounds of frozen product.

Warehousing frozen foods presents a phase of the industry which is of prime importance. Much money and work is represented in the packaged frozen food placed in the warehouse, and unless this phase of the process of packing frozen food is kept strictly under control all previous steps would be of little value. Generally it has been accepted that zero storage is sufficient; but this axiom has been modified in light of recent experiments and minus 10°F is now the desired storage temperature for most frozen foods. Blanching vegetables inactivates enzymes present in vegetable tissues. In prolonged storage at below 0°F several authorities believe that there is a degree of reactivation of the enzymes. Foods properly processed and packaged will last much longer at minus 10°F storage before developing off flavors due to enzymic actions than they would at 0°F.

Enzymes are organic catalysts—silver, gold, platinum are examples of inorganic catalysts.

Vegetables are blanched—cooked in boiling water or live steam—to commercially inactivate these enzymes. If this were not done foods would develop off-odors, taste and colors even after freezing and storage at -10°F.

We check for inactivation of catalose and peroxidose enzymes—these are a heat resisting variety; if we have inactivated them, then we know that our product will not develop these off-flavors, taste and colors.

Lower storage temperatures, however, necessitate the use of better vapor barriers around the food to retard dehydration due to vapor pressure differentials between room air and food since it is not practical to consider artificially raising room relative humidity to minimize the vapor-pressure differential. Also, proper staking procedures to prevent cases from direct contact with floors and walls by means of floor racks and wall battens is often neglected in cold storage warehouses. Placing cases directly against walls have resulted in stack temperatures above freezing even though rooms were at 0°F. Any product coming into storage should be loose stacked if the product temperature exceeds plus 10°F; and under no circumstances should cased frozen foods be stacked in a solid block. At least one inch of space should be maintained on at least 2 sides of adjacent cases to allow air circulation in the stack. In addition to maintaining a storage temperature of minus 10°F and properly stacking cases in the warehouse, it is a prime requisite to hold temperatures at a constant level. Fluctuating temperatures are direct contributors to dehydration. Temperature variations in excess of 1 and one-half degrees, plus or minus, from minus 10°F, should be investigated and proper remedial action should be taken to prevent such fluctuations.

In transporting frozen foods to distributors' warehouses, or to commercial warehouses in the market area, the processor loses control of his product temperatures. Since proper control of temperatures is not possible by the packer, he should protect himself by: (1) ascertaining that no product is shipped out of his warehouse unless the temperature is below 0°F; (2) by loading only into properly insulated refrigerator cars which have been cooled to not less than 10°F; and (3) by shipping a sealed recording thermometer within the refrigerated car with the frozen foods with the recording thermometer returned seal intact to the processor. If thawing occurs enroute the recording thermometer will substantiate a claim against the transportation agency, and it will allow the packer to prevent the food from entering the market and jeopardizing the packers' brand name. Most distributors are aware of the necessity of maintenance of proper storage temperatures, but it becomes their responsibility to see that the storage boxes in the market areas are adequate for the proper storage of the food until the consumer makes his selection and purchase.

In addition to "bridging the gap" for management between refrigeration fundamentals and practice, the refrigeration engineer also must perform a similar function for refrigeration operators at their practical level of approach to operating problems. It is essential that gauges and thermometers be properly located in the system to enable the operator to keep an accurate log of the operation of the system. Any radical change in operation can be instantly noted and corrected prior to major difficulties or breakdowns. Operating logs will most frequently show excessive head pressure due to non-condensable gases in system, improper float valve action, excessive suction line superheat, excessive discharge temperatures, stuck float valve on intercooler or insufficient liquid in intercooler, stuck float valve on low pressure receiver, insufficient ammonia in the system and excessive oil in system. The effect of radical changes in the operating conditions is apparent to the operator, but the reason for the change will at

(*Continued on Page* 23)

Ralph E. Turner, WSE Life Member and Former Editor of Power Engineering, Dies

Ralph E. Turner, former Editor of *Power Engineering*, died after a short illness on November 26, at his home in Western Springs, Ill. Although Mr. Turner had retired from active service in 1948, he retained a keen interest in company activities.

Ralph Turner was one of the older members of the Technical Publishing Company organization, having started in 1908 as associate editor of the *Practical Engineer*, which was the name of the magazine before it was changed to *Power Plant Engineering* in 1918. Born in Columbus, Nebraska on March 9, 1879, his father, Moses Kennedy Turner, was the editor and publisher of the local Columbus newspaper. Thus his indoctrination into editorial technique began at an early age. Newspaper work evidently was not his forte because, after graduation from the Columbus high school, he enrolled as an engineer student at the University of Nebraska, from which he graduated in 1906 with the degree of B.S. in E.E. During the first two years of his college career he worked, spare time, with his father as business manager of the Columbus Journal.

Following graduation, Mr. Turner went to Pittsburgh to enter the employ of the Westinghouse Electric and Manufacturing Co. as student apprentice in 1906. A year later, became an erecting engineer for that company. In October 1908 he left Westinghouse to move to Chicago and become associate editor of the *Practical Engineer*. This was the beginning of what was to be a long and interesting editorial career. For 40 years, first as associate editor, then as managing editor, and finally as editor. Ralph Turner was a major force in shaping the editorial character of *Power Plant Engineering*. For many of the early years, in fact, Ralph Turner, together with Arthur L. Rice, the editor, constituted the entire editorial staff.

Ralph E. Turner

In 1911 he was married to Hulda Victoria Malm, who with four sons, survives him. Shortly after their marriage, the Turners built their house in Western Springs and lived there ever since.

Ralph Turner was a warm hearted, good natured, likable person and it was inevitable that he should take a great interest in the social and civic life of the village. Through the years he gave his effort to many local activities. He was a member of the school board, served as village clerk and was active in church work. In his younger days he had an excellent voice and derived much pleasure from solo and quartet singing. At one time he was a member of the Apollo Quartet. With four boys of his own he was interested in young people's activities and for many years was active in Boy Scout work.

Professionally, he was active in a number of engineering organizations. He was a life member of WSE having joined in 1920. He was a life member of ASME and besides serving on various committees, he was chairman of the Chicago Section of the ASME in 1938-39. In addition, he had been an associate member of the National Association of Power Engineers since 1908. For the year 1943 he served as secretary-treasurer of the Illinois Engineering Council, and from 1943 to 1944 he was western vice president of the National Conference of Business Paper Editors. Finally, Mr. Turner was a registered professional engineer in the State of Illinois.

Mr. Turner retired from active service with the Technical Publishing Company, of which he was a director, in 1948 to become editorial advisor. His impaired health prevented him from devoting much time to company affairs since his retirement but he retained a deep personal interest in the magazine which was so much a part of his life until the very end.

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Motor Truck Terminals

By HARRY F. CHADDICK
Chairman, Motor Truck Terminals Committee
City of Chicago

A new chapter is being written in Chicago's transportation history by the over-the-road trucking industry. Like so many of the other chapters in the century-old book that recount Chicago's prominent rise in becoming the transportation center of the world, the new chapter tells about the stupendous growth of the trucking industry within the past two decades and how the industry has taken a bold step to solve its terminal and street traffic problems.

The phenomenal growth of the industry created a series of street traffic problems. Streets that were laid out for the horse and buggy age soon became outmoded for the speedy passenger car and the versatile motor truck.

While tremendous improvements subsequently were made in the vast network of streets to accommodate the millions of vehicles using them daily, nonetheless a new scientific approach is needed to solve the motor truck terminal problem to the end that highway trucks will substantially relieve traffic on the heavily traveled streets and at the same time enable the carriers to better serve the constantly growing volume of freight traffic entering and leaving the city by motor truck.

The answer to the problem for the most part is found in a comprehensive 102-page report submitted to Mayor Kennelly on April 13, 1950 by a committee known as the Committee on Motor Truck Terminals appointed by the Mayor to make studies and recommendations concerning the operations of motor truck terminals. This committee, which was composed of representatives of labor, motor carriers, warehouses, shippers, and the public, after conducting a series of exhaustive surveys recommended the establishment of completely integrated trucking centers within the heart of the Great Central Market. With lightning speed the City Council adopted the report and recommendations and proceeded at once to amend the zoning laws and to make provision for the creation of Motor Freight Terminal District No. 1. That project now is well under way.

The huge $80,000,000 to $100,000,000 overall truck terminal program envisioned by the Mayor's motor truck terminal committee will eventually concentrate the terminal-handling of the vast amount of the city's motor freight commerce within four exclusively-zoned Motor Freight Terminal Districts, each consisting of approximately 4,000,000 square feet of land space. Each district would accommodate from 75 to 100 separate trucking companies in addition to hotels, recreational facilities, restaurants, currency exchanges, repair shops, service stations, parking areas and truck-rail consolidating terminals.

Each district would be strategically located, both from the viewpoint of their proximity to freight shipping-receiving centers and to the network of superhighways which eventually will encompass the city. Objective is to reduce to an absolute minimum the use of highway, pickup, and delivery units would make of city streets. Estimates made by the committee show that more than 12,000 highway units are operated daily on runs to and from Chicago by 378 of the 492 long-distance common carriers serving the city. In addition, these same carriers operate a total of 5,064 pick-up and delivery vehicles.

Another big factor would be the removal from the city streets of a large number of vehicles engaged in interchanging traffic between carriers in Chicago. This traffic is estimated at around 28 per cent of the total volume handled by the carriers at the existing 245 terminals in various parts of the city. Equally important to relieving unnecessary traffic movements from the streets are the private and public parking areas already in operation for the off-the-street parking of trucks. This was accomplished by an ordinance passed by the City Council against parking of trucks on streets in the area bounded by Van Buren Street on the North, 39th Street on the South, Western Avenue on the West and Lake Michigan on the East.

Although it has been only slightly more than a year since the City Council adopted the prolific 102-page report of the committee and adopted new zoning ordinances governing the location of new motor truck terminals in the city, the first fruits of the committee's labor are already much in evidence, and on a large scale at that.

Four motor freight terminal districts were recommended but only the area of Districts No. 1 and No. 2 specifically singled out. The other two are still under study. District No. 1 is bounded on the West by Western Avenue; on the East by Wood Street; on the North by the old Illinois-Michigan Canal which is to be converted into a super highway; and by 33rd Street on the South. Plans also include the establishment of 33rd street as a through street for the use of motor trucks from Iron Street (1400 W.) to Western Avenue with an underpass under Ashland Avenue.

District No. 1 was selected as the initial terminal area because it is immediately adjacent to the projected super highway to be built in the depressed bed of the Illinois-Michigan canal and because of the area's proximity to 35th and Ashland Avenue. The Mayor's committee found this point, by extensive surveys, to be the geographical freight center of Chicago. This strategic freight shipping location was found to be within a radius of one mile of 9.8 per cent of the total number of 128,400 truck stops made in the city daily. It is within two miles of 27.2 per cent of the total truck stops and within four miles of 66.8 per cent of the stops. It is also within a few city blocks of a number of terminals located in the Iron Street district, which is designated as Motor Freight Terminal District No. 2. The two districts would be connected by 33rd street with an underpass at Ashland Avenue, thus avoiding the use completely of other city streets by thousands upon thousands of trucks used for the interchange of freight between carriers and the minimum use of streets by highway, pick-up and delivery units.

Studies made by the committee show the fallacy of recommendations of earlier theorists that truck terminals should be located on the outskirts of the city. The committee's findings showed that the terminals in the concentrated areas would shorten the distance of truck travel between truck terminals and the places of business of shippers and receivers by approximately 40 per cent. Terminals on the city's outskirts would increase congestion as well as casualties, not decrease them. Furthermore, because of the heavy volume of freight carried in the 3,500,000 highway units entering and leaving Chicago annually, the committee ruled against the construction of so called union truck terminals as a remedy to the problem. No union terminal could be built large enough to accommodate efficiently the huge volume of motor freight traffic handled in Chicago daily. Latest estimates (1949) showed that the trucking industry in Chicago employed 30,000 persons and that gross revenues of carriers operating to, from and through the city totaled in excess of $1,000,000,000 a year. This statistic alone would establish Chicago as the leading trucking center of the country.

The investment of some $18,000,000 in the 245 existing truck terminals scattered throughout the city would not be a complete loss for the carriers when they are abandoned. Although a large number of them are used inefficiently in the handling of freight traffic, virtually all of them could be reconverted at little expense, into commercial enterprises, such as light manufacturing, bottling or printing plants.

On the other hand, concentration of terminals in the four areas and the efficiences that would result could well amount to savings amounting to between $5,000,000 and $10,000,000 annually. The average motor carrier would save through increased efficiency and through the reduction of loss and damage claims enough money in five years to pay for the construction of a new building—certainly a tremendous justification for the relocation into the recommended areas.

Remarkable progress already has been made in District No. 1. More than $10,000,000 in new terminal construction is either completed, under way or planned. All of the 30 acres of vacant property in the area has been sold at a nominal average price of 75 cents a square foot and negotiations are in progress to make the balance of 3,500,000 square feet (on which buildings now stand) available for terminal sites.

In addition to making plans available for the reconversion of old terminals into commercial enterprises, the committee has also developed low-cost construction plans for new terminals and for the efficient handling of freight in the terminals. In its investigation of freight handling methods used in existing terminals throughout the city, the committee found that less than 10 per cent of the present buildings were constructed to accommodate mechanical freight handling equipment or to permit utilization of modern methods of transportation.

Transportation experts who have had an opportunity to review the committee's report have estimated that there is an excess of $10,000,000 in transportation cost wasted under the present scattered terminal system, and unless corrective measures are taken, Chicago may find itself straight-jacketed and unable to solve its problems for many years to come. The trucking industry, the committee is convinced, has not deeply rooted itself as yet and is still flexible and able to adjust its operations into the plan recommended.

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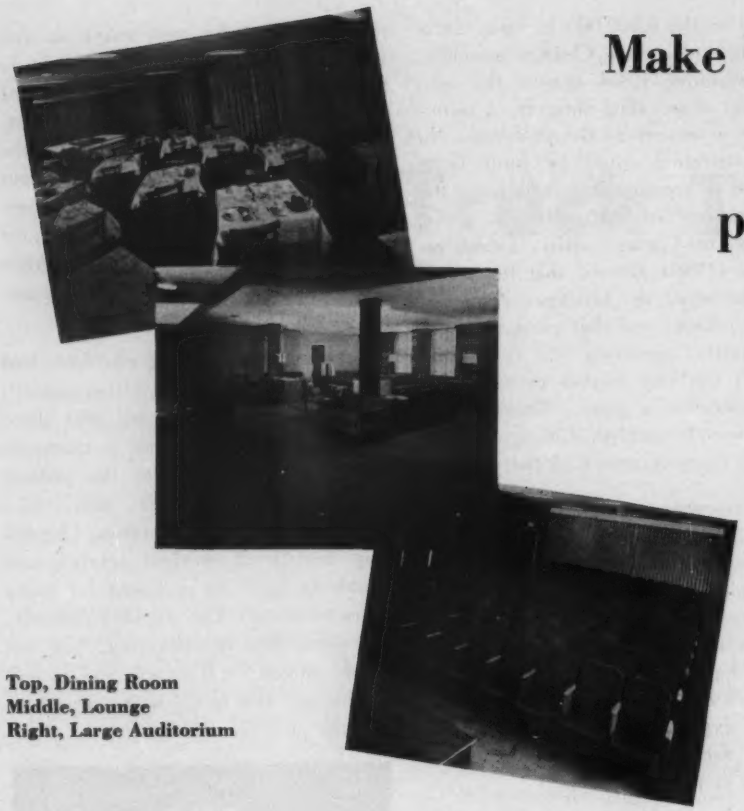

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Headquarters of The Western Society of Engineers

Traffic Congestion Costs Chicago More Than One Million a Day

Between one and two million dollars a day—that's what traffic congestion is costing a city like Chicago, according to Ben F. Ostergren, manager of the County and Local Roads Division of the American Road Builders' Association, in a speech before the County Engineers Association at Columbus, Ohio. Delays in time, accidents, lowered morale of workers and disruption of mercantile and industrial schedules accounts for this huge toll, he asserted.

Emphasizing the danger of the federally-imposed shortages of steel for highway purposes, Mr. Ostergren pointed out that Chicago, in its effort to escape from its traffic bottleneck, requested 3,000 tons of steel for an extension of Lake Shore Drive. It was given 250 tons.

"That tells the whole story of the present steel situation. We ask for a certain amount of steel and get one-tenth of what we need," the ARBA official told the county engineers. In the overall picture, highways are being allotted 27.9 per cent of the carefully-screened demand for structural steel in the first quarter of 1952. He quoted the Bureau of Public Roads as reporting 656 important road projects as being delayed for lack of steel.

The speaker conceded that steel was sorely needed in the defense effort, but went on to show that highways were an essential part of that effort. In proof of this, he cited the cases of the Walker Bulldog Tank being built by General Motors at Cleveland and the Matador pilotless bomber being built by the Glenn L. Martin Company at Baltimore. In both instances, from 80 to 90 per cent of the parts and materials used were transported to the plants by trucks over highways. "In addition to these impressive percentages, much of the finished product leaves the factory by truck or under its own power. Moreover a great majority of defense plant workers use the highways getting to and from the job," he declared.

Major General Frank A. Heileman, chief of army transportation, was quoted by Mr. Ostergren as stating: "The extent of highway facilities and the condition they are in have a direct bearing on the state of national preparedness."

Mr. Ostergren touched on failure to improve highways as a safety factor, and remarked that the one-millionth fatality which occurred in December 1951 was a resident of Cleveland, Ohio. "Improved highway design is an absolute necessity if fatalities are to be reduced," he declared. Straightening and widening our highways alone would result in saving 10,000 lives a year, he insisted.

Touching upon a subject close to the county engineers' hearts, Mr. Ostergren maintained that there was a crying need for trained engineers in the highway field at all levels—federal, state, county and city. He referred to a statement by the Highway Research Board that there was currently a shortage of 10,000 professional and sub-professional men in highway employment, and he advocated higher salaries and improved working conditions as an inducement to young engineers now graduating from our engineering schools.

"If we continue our present penurious policy toward engineers' compensation, there will continue to be a shortage of engineers in this field, and with a shortage of engineers, the day when we may catch up with our highway deficiencies will be postponed," he said in conclusion.

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Here are the rules:

Any member of Society may compete regardless of grade of membership.

Papers shall not be highly technical in nature. A clear, concise and interesting coverage is desired rather than complex formulae or derivations. The subject discussed should be of general interest to engineers but should not be of a political or highly controversial nature.

All members of the Society who wish to submit papers in this contest should contact the Secretary as early as possible and not later than February 1, 1952, and request a copy of the rules governing the competition and an outline of the minimum requirements for acceptance of papers. These cover in detail the mechanical make-up which should be followed in preparing and submitting papers for the contest.

Papers must be submitted to the Secretary for acceptance by April 1, 1952. If the Secretary finds that they meet the minimum requirements of the contest, he will forward them to the Awards Committee for review. The papers will be identified by number only. The Secretary of the Society is the only person who will maintain the key to the authors.

If any paper does not comply with such minimum requirements, the Secretary will so advise the author and discuss with him the points which are below the minimum requirements. The papers which are accepted will be forwarded to the Awards Committee for judging not later than May 1, 1952. Papers which have not met the minimum requirements by that time cannot be considered for prizes.

Papers which are accepted will be judged on originality of presentation, editorial merit and value to the engineering profession.

The papers submitted must not have been previously published in substantially the same form. No copyrighted materials shall be used unless permission has been obtained and so indicated. All manuscripts, drawings, etc., are to become the property of the Society and cannot be published without the consent of the Society.

If the papers submitted are NOT of sufficient merit to warrant the award of any or all of the prizes, the Awards Committee reserves the right to award less than the five established prizes or to postpone the competition.

The winners will be announced and the prizes presented at the annual meeting of the Society in June, 1952.

WSE Executive Secretary will furnish you with a complete set of rules and minimum requirements on request.

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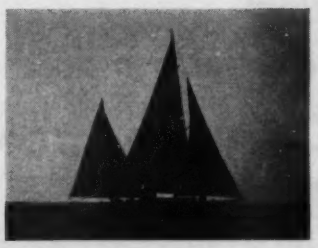

IN THE M-SHIP'S SAILS

WSE Personals

Harold A. Bergen has accepted a position as manager of the Technical Manual Department of the Belmont Radio Corporation. He formerly was with the Stemar Company.

Chester F. Sargent, partner of the firm of Sargent & Lundy, Engineers, has announced his retirement.

The Chicago and North Western Railway Co. has announced several changes in their Engineering Department. **M. E. Koenig** has been appointed Division Engineer, Western Division, with headquarters at St. Paul, Minn. **M. S. Reid** has been appointed Division Engineer, Madison Division, with headquarters at Madison, Wis. A third change announced by the railroad is the retirement of **Leo C. Smith,** Division Engineer of the Madison Division. Mr. Smith was with the Chicago and North Western Railroad for 47 years, 28 of which were with the Engineering Department.

After spending a three-week vacation in Phoenix, Ariz., **Dr. Gustav Egloff** returned to Chicago to address the Fourth Annual Chicago Area Career Conference on December 27. His topic was "Chemistry as a Career." This conference was held at the Illinois Institute of Technology December 27 and 28.

On January 3, Dr. Egloff addressed the Evanston Rotary Club. Title of his talk was "Living Off Petroleum."

In connection with the meeting of the Kansas City Oil Men's Club, Dr. Egloff appeared on a television program in that city on January 20. The following day he gave a talk at a luncheon meeting of the Oil Men's Club.

Earl G. Abbott, formerly with the General Electric Co. in Chicago, has been transferred to that company's office in Schenectady 5, N. Y. He is in the apparatus department.

M. W. Oettershagen, an engineer with the Bureau of Rivers and Harbors for the city of Chicago for the past 35 years, has been named consulting engineer for the Chicago Regional Port District. For the past 25 years he has acted as advisory engineer to the City Council Committee on Harbors, Wharves and Bridges.

President of the American Association of Port Authorities in 1930, Mr. Oettershagen has been active for many years as the city's representative at meetings of the National Rivers and Harbors Congress at Washington, D. C. and Chicago and also at annual meetings of the Mississippi Valley Association at St. Louis, Mo. Since 1923 has been delegated at the Chicago's representative to the annual convention of the American Association of Port Authorities in all of the major port cities of North America.

M. H. Arveson has been elected to a four-year term as director-at-large of the American Chemical Society.

Mr. Arveson is technical director of the Indoil Chemical Co., a subsidiary of the Standard Oil Co. of Indiana. He is a former director of the society's Chicago section and has been active in its affairs nationally.

It has been announced that **E. Gordon Fox** has retired as of January 1, 1952 as a Vice President of the Koppers Company, Inc., and as Operating Manager of the Freyn Engineering Department of that company.

Mr. Fox, who was 65 on January 1, will remain with the Freyn Company for a time in a consulting capacity.

During the past two years, while he headed the local Freyn Engineering Department, it has undergone a five-fold expansion. It now holds a place as one of Chicago's largest engineering organizations.

Mr. Fox has long been identified with W.S.E. and recently attained the status of Life Member. He served as President of the Society in 1940-41 and was Chairman of the Headquarters Committee for two years when plans were being developed for the present headquarters. Mr. Fox now is Chairman of the Washington Award Commission.

(*Continued from Page* 5)

showed to be the case when plastered ceilings were attached to them. The lath and plaster ceiling constitutes a thin slab which ties together the underside of the joists. Analysis shows that the joists and the portions of the ceiling slab between constitute a modified form of inverted "Tee" beam.

It is important to note that gypsum lath and plaster and metal lath and plaster ceilings continue to be widely used in new construction. Under average occupancy conditions they do not crack; seldom is a floor deflection of even half as much as that mentioned in the formula encountered in residential occupancies. The actual live loads imposed on floors in such occupancies are usually considerably less than they are designed to carry.

Where the Deflection Formula Fails

The criterion very definitely indicates that plaster cracks can be expected if deflections exceed 1/360. But note the lower diagram in Figure 2 and the third curve from the bottom in Figure 1. These show a ceiling assembly which did not crack until the deflection exceeded the permissible by 70 per cent; at the same time it was carrying a uniform load of 274.4 lb. per square foot, far beyond any which would ordinarily be encountered in plastered buildings. This was a suspended metal lath and plaster ceiling, constructed quite differently from the nailed-on type.

Another method of assembly employs furring clips to hold the plastered ceiling away from the structural supports. At the same time, the clips provide firm suspension for the ceiling. They are designed so that bending or flexural movements in the supports are dissipated by the clips through a weak hinge or spring action. Several samples of such a system were tested. Average results are shown in diagram "C" in Figure 3, and by the lowest curve in Figure 1. Carrying the exceptional uniform load of 389.0 lb. per sq. ft., the plaster on the ceiling did not crack until a deflection of 1.313 inches was reached. This is 160 per cent greater than the permissible under the formula.

When an 8-foot long sheet of gypsum lath was nailed direct to the underside of the joists, at the central portion of the span, and ordinary 16 x 48-inch sheets were used for the remainder, the plastering did not crack until the joists deflected 0.82 inch. This is more than six times as much as was required to crack the plaster on the ordinary gypsum lath.

In yet another type of nailed-on construction, the deflections, wheen fiber insulating lath was used as the plaster base, reached 0.9 inch, 80 per cent more than the allowable, before the plaster cracked. While deflection in such an amount was very likely accompanied by compression or even tearing of the fibers in the lath, the fact that the plaster did crack can be cited as still another breakdown of the deflection formula.

Summary and Conclusions

1. Tests of full-span samples of modern lathed and plastered ceilings proved that the long-standing formula for computing maximum allowable deflections of supports which carry lathed and plastered ceilings, is not properly based where plaster cracks are the limiting criteria.

2. The so-called beam-deflection design criterion formula, applicable to plastered construction does not correctly measure or state the true relationship between loaded horizontal structural supports such as joists, floor beams, purlins or girders, and the amount of deflection they can withstand before a lathed and plastered ceiling attached to them will crack. This has, in many instances, led architects, engineers and builders to use structural members of heavier and/or deeper sections than are actually required at correspondingly increased cost. It has placed unnecessary, harmful, and costly restrictions on the use of interior lathing and plastering.

3. The test program conclusively demonstrated that variations in the methods used to attach lath and plaster to structural supports produce differences of as much as 900 per cent in plaster crack resistance, the construction being otherwise identical.

4. Certain types of lathing and plastering, widely used and recognized for their freedom from plaster cracks actually will crack at deflections much smaller in proportion to the span length than the plastering is presumed to withstand in accordance with the deflection formula. Here the formula is misleading and unrealistic.

5. Data developed as the result of this research show that the deflection formula does not differentiate between ceilings of the suspended type, those attached by means of resilient or other clips, and those which are firmly nailed to and in direct contact with the supports. The suspended and clipped types are comparatively free to deflect according to a pattern and in an amount largely governed by the nature and means of suspension. Deflections of ceilings in which

(*Continued on Page* 21)

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Legislatures Will Spur New Construction in 1952

During 1952 state legislatures will be asked to vote large sums of money for new construction and improvements. With fall elections in the air, they will probably be generous, says Engineering News-Record, McGraw-Hill publication.

Measures confronting legislators of 16 states in regulator budgetary or extended sessions include funds for highways, schools, institutions, airports, housing, industrial developments, water supply and even traffic congestion, the magazine says.

Such sessions are scheduled in Arizona, California, Colorado, Georgia, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Missouri, New Jersey, New York, Rhode Island, South Carolina and Virginia.

The trend toward added highway user taxes and bond issuance to finance long-range highway modernization programs will spread, the magazine predicts. More toll highways can be expected and extensions and connecting links are likely on those built or under construction.

New and increased aid for schools also is in the offing, according to the magazine. Some states will follow closely the progress of Georgia, Indiana and Maine with their 1951 authorizations of revenue bond financing to provide state aid for school construction. These bonds are to be amortized from rentals paid by local school boards for use of the buildings, and this type of financing may spread rapidly, it is predicted.

Additional legislation can be expected to facilitate slum clearance and rehabilitation. Urban redevelopment laws are effective now in 33 states.

Laws authorizing municipalities to issue revenue bonds to finance construction of industrial buildings for lease to private industry may increase, despite opposition from organized investment bankers.

Creation of privately financed and operated state credit corporations to provide credit for business also is likely to spread. Such corporations are functioning in Maine, New Hampshire and Vermont and under consideration in Massachusetts.

Some states also will decide whether the nation's growing water problems will be handled by the federal government or by state and interstate agencies, the magazine says.

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Centennial of Engineering

Impetus has been given to the rounding-out of the great convocation of national and international engineering societies to be held in Chicago next September as part of the celebration of the Centennial of Engineering, with the election of Chancellor Henry T. Heald of New York University to the chairmanship of the convocation committee.

Other members of the committee are E. R. Weidlein, president of the Mellon Institute of Industrial Research, at Pittsburgh; Frederick V. Geier, president of the Cincinnati Milling Machine Co., Cincinnati; A. P. Greensfelder, chairman, Fruin Colnon Contracting Co., St. Louis; and E. G. Bailey, vice president, Babcock and Wilcox Company, New York.

The immensity of the convocation program is reflected in the fact that practically all the major meeting rooms of six of Chicago's largest downtown hotels have been reserved for the sessions which will cover a 10 day period. This is in addition to a large number of meetings scheduled at the Museum of Science and Industry.

During the Centennial convocation, there will be individual symposia and technical meetings on problems being encountered in almost every phase of engineering. More than a hundred nationally known speakers will participate. In addition, prominent laymen will appear on the panels to express what the general public expects from the engineering profession in the continued advance of American social and economic standards.

At least 25,000 representatives of 41 national and international engineering societies are expected in Chicago for the convocation, according to Major Lenox R. Lohr, the Centennial president.

Commonwealth Edison Company Makes Changes in Key Personnel

Important promotions in system operating officials of Commonwealth Edison Company were announced today by Charles Y. Freeman, Chairman. Two veteran vice-presidents, **Alex D. Bailey,** after 48 years of service, and **Curtis A. Lambert,** after 45 years of service, will retire February 1, 1952.

In a new organization alignment affecting system engineering and related activities, **Raymond D. Maxson,** now engineering Vice-President of Public Service Company of Northern Illinois, was also elected Vice-President of the Edison Company. Mr. Maxson will thus be in charge of corresponding work in both companies.

The organization under **Mr. Maxson,** in both companies, will be divided, Mr. Freeman said, into four subdivisions in charge of newly created executives who similarly will have corresponding duties in each company. The new posts will be held by men who have had long experience under Mr. Bailey and Mr. Lambert. They are:

Manager of Engineering—
Titus G. LeClair

Manager of Construction—
John F. Sullivan, Jr.

Manager of Power Production—
Vern L. Stone

Manager of Power Supply—
Earle Wild

Mr. Maxson, 53 years old, graduated in electrical engineering, University of Illinois, and started with the Public Service Company of Northern Illinois at Crystal Lake in 1921. He worked in the engineering departments of that Company in various district offices in different capacities progressing to the rank of Division Manager in 1936, and to Vice-President in 1943. Mr. Maxson has been active for many years in the work of the American Institute of Electrical Engineers and the Western Society of Engineers. Mr. and Mrs. Maxson have lived in Elmhurst for over 25 years. They have two sons, one a student at Purdue University and the other at the University of Illinois.

Mr. LeClair, age 52, Manager of Engineering, joined the Edison Company in 1923, and has been Chief Electrical Engineer for the past two years. He is a graduate of the University of Idaho, and past president of the American Institute of Electrical Engineers and of the Western Society of Engineers.

Mr. Sullivan, age 49, Manager of Construction, came to the Edison Company in 1925 as a graduate of mechanical engineering, University of Wisconsin. For the past several years, he has served as Mr. Lambert's assistant. Mr. Sullivan is a past president of the Illinois Engineering Council and is Treasurer, Western Society of Engineers.

Mr. Stone, age 50, Manager of Power Production, has been with the Edison Company since 1924. He obtained his technical education at Lewis Institute and at Armour Institute. Mr. Stone has spent his entire time with Edison in generating station work advancing to the position of Superintendent, Generating Stations in 1951.

Mr. Wild, age 49, Manager of Power Supply, entered the Edison Company in 1924. He is a graduate of the Massachusetts Institute of Technology. Mr. Wild has been directing the load dispatching work under Mr. Bailey's guidance, for the past several years. During the war, he served WPB as Power Coordinator for the New England and other east coast states.

Mr. Freeman also announced that **John R. Michel,** age 52, was appointed a staff assistant to Mr. Maxson with the title, General System Engineer, and **Myron Lukey,** age 42, will continue to be a staff assistant to Mr. Maxson as Administrative Engineer. Michel has been with the Edison Company since 1923, and recently has been assistant to Mr. Bailey, while Lukey has been associated with Public Service Company since 1925.

Mr. Bailey, who retires as Vice-President, has been in charge of operating and engineering matters since 1944. He has been nationally prominent for many years in the field of steam generation of electricity, and is well known in engineering colleges because of his active interest in engineering education. He is Vice-Chairman of the Board of Trustees, Illinois Institute of Technology; an honorary member and past president of the American Society of Mechanical Engineers; a member of the Western Society of Engineers and of the Newcomen Society.

Mr. Bailey received a degree in Mechanical Engineering from Lewis Institute in 1903 and later that year joined the Edison Company as a draftsman. From 1906 he was successively Assistant Chief Engineer and Chief Engineer at Fisk Station. In 1921, he was made Superintendent of Generating Stations, and in 1936 became Chief Operating Engineer. Mr. Bailey was awarded the degree of Doctor of Science by Northwestern University in 1942.

Mr. Lambert has spent his entire Edison career in construction activities, and has had charge of construction and maintenance of buildings and of overhead and underground lines. He was elected Vice-President in charge of Construction in 1944 and in that capacity has directed the unprecedented building program of the past six years. This included the new Ridgeland generating station.

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A.S.T.M. Spring Meeting at Cleveland March 3-7, 1952

During Committee Week in Cleveland —March 3 to 7, inclusive—the technical feature of the 1952 Spring Meeting of the American Society for Testing Materials, scheduled for Wednesday, March 5, at the Hotel Statler in Cleveland, is a Symposium on Testing Metal Powders and Metal Powder Products. Comprising several papers by leading technical men in this field, the symposium is sponsored by ASTM Committee B-9 on Metal Powders which is responsible for the ASTM research and standardization work in this field. All those interested in this subject are cordially invited to attend this meeting.

Following the symposium there is to be a reception under the auspices of the ASTM Cleveland District, for the Society's president, T. S. Fuller, Engineer in Charge of Works Laboratory, General Electric Co., Schenectady, with a dinner and short technical talks by President Fuller and A. P. Rupp, Supt., Radioisotope Development Dept., Oak Ridge National Laboratory. Mr. Rupp will discuss Radioactive Techniques and President Fuller will give a portion of his talk on Solving Problems in Materials.

Throughout the week of March 3 to 7, inclusive, there will be over 300 meetings of ASTM technical committees meeting during what is known as ASTM Committee Week.

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Laminated Wood vs Structural Steel

Washington planners and the lumber industry are offering fabricated lumber as a practical alternate for structural steel, according to *Engineering News-Record.*

The idea was used during World War II, but recent developments in the manufacture of plywood and in chemical treating of wood give it greater toughness and heat resistance, making it practical as a steel substitute in a wide variety of construction, spokesmen say.

In many fields once exclusively served by lumber, metals have taken over because they have been available as "package items." The lumber industry admits that it has lagged behind metals and plastics industries in design and utilization, but now it feels it is catching up again.

Industry spokesmen point to the tremendous growth of the plywood industry as an initial step forward. By fabrication with the newly developed gluing technology, superior stress factors can be achieved and they can now give military and civilian designers a product designed for particular needs, they say.

For example wooden spans instead of steel could save as much as 300 tons of steel in one airplane hangar. And laminated timbers have equal strength in the flash fires that occasionally occur in aircraft hangars and such structures, say wood's proponents.

A saving of about 95 per cent of scarce metals can be made by using fabricated timbers as residential, commercial, industrial, school, church and bridge trusses.

Industry spokesmen say in most cases extensive research will not be needed for lumber to replace metal. For instance, in the case of kitchen cabinets, wardrobes, bathroom cabinets, door jambs and sliding doors, the minimum percentage of saving would be 90 percent, and none of these uses would involve more than a few minor changes in design.

(*Continued from Page* 17)

the lath is rigidly nailed to and held in direct contact with the joists is naturally more restrained, particularly in the case of metal lath and gypsum lath.

6. Ceiling deflections necessary to cause plaster cracks are a function of: (a) type of lath; (b) method of attaching the lath, or the lathed and furred or suspended ceiling to the structural supports; (c) the resiliency and strength of the plaster mixture; (d) the plaster thickness; (e) the live load; (f) the span length; (g) in nailed-on ceilings, the depth of the joists.

7. There is an apparent confusion between the requirements for rigidity or fredom from sway in floors and the requirements intended to prevent plaster cracks. The former are related to comfort, as when walking on a floor, and those bearing on stiffness intended to limit floor deflections to those which will not cause dishes to rattle, and to other similar "creature" discomforts and annoyances attendant on occupancy. There is no evidence to show there is a direct relationship between the two, but it is quite possible that satisfying the requirements of one may also satisfy the requirements of the other.

8. The fact that plaster on lathed ceilings does crack, even with floor deflections considerably less than have heretofore been considered necessary to cause cracks, but that there are many millions of square feet of uncracked plaster ceiling surface in actual use indicates that actual floor loads are insufficient to cause even the smaller deflections which will crack plaster. Therefore, it is apparent that live load requirements stipulated by building codes are on the strong side and that they might well be re-examined to more accurately reflect occupancy conditions. Such a step in conjunction with a liberalization of fiber-stress limitations, such as were adopted during World War II, may result in a reduction in materials requirements and a consequent saving in the cost of buildings.

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WSE Applications

In accordance with the By-laws of the Western Society of Engineers, the following names of applicants are being submitted to the Admissions committee for examination as to their qualifications for admission to membership into the Society in the various grades, i.e., Student, Associate, Member, Affiliate, etc. All applicants must meet the highest standards of character and professionalism in order to qualify for admissions, and each member of the Society should be alert to his responsibility to assist the Admissions committee in establishing that these standards are met. Any member of the Society, therefore, who has information relative to the qualifications or fitness of any of the applicants listed below, should inform the Secretary's office, 84 E. Randolph St., RAndolph 6—1736.

112-83 D. Vernon Fawcett, 1641 E. 53rd St., attending Illinois Institute of Technology.

113-83 Wilmer C. Dutton, Jr., Director of Planning, Housing Authority of the County of Cook, 33 N. LaSalle St.

114-83 Marvin P. Macy, Eng. Draftsman, The Hess Co., 1855 S. 54th Av., Cicero, Ill.

115-83 Caesar M. Danesi, District Manager, Griscom Russell Co., 20 N. Wacker Dr.

116-83 Anthony W. Hohner, Design and Project Work, Curtiss Candy Co., 402 E. North Water St.

117-83 Donald B. Littrell, General Manager, George A. Fuller Company, 111 W. Washington St.

118-83 John V. Hajny, Draftsman, J. R. Hooper & Co., Brookfield, Ill.

119-83 K. Austin Jewell, Chief Engineer, Austin Jewell Industrial Design Service, Evanston, Ill.

120-83 Kenneth C. Leslie, Electrical Engineer, Commonwealth Edison Co., 72 W. Adams St.

121-83 James B. Murray, Engineer, Illinois Bell Telephone Co., 208 W. Washington St.

122-83 Richard R. Primrose, Inspector (Bldgs. & Equip.), Commonwealth Edison Co., (Transp. Dept.), 215 S. Morgan St.

123-83 Sidney Robbins, President, Contractors & Builders, Inc., 228 N. LaSalle St.

124-83 Stanley T. Siegel, Traffic Engineer III, City of Chicago, City Hall.

125-83 Douglas J. Nankervis, Gas Sales Engineer, General Meters & Controls, 205 W. Wacker Dr.

126-83 Wilson T. Herren, Vice President, Henry Pratt Co., 2222 S. Halsted St.

127-83 Richard M. Smith, Central Office Program Engineer, Illinois Bell Telephone Co., 212 W. Washington St.

128-83 William F. Wilt, Graver Tank & Manufacturing Co., Inc., East Chicago, Ind.

129-83 Harry A. Wolter, Mechanical Research Engineer, Zenith Radio Corp., 6001 Dickens Av.

130-83 John E. Linden (Rein.), Staff Engineer; DeLeuw, Cather & Co., 150 N. Wacker Dr.

131-83 Arie P. DeSnoo; DeLeuw, Cather & Co., 150 N. Wacker Dr.

132-83 Charles F. Rubin, 5902 W. 26th St., Cicero, Ill.—attending Illinois Institute of Technology.

133-83 Allie Mizevitz, Engr., Draftsman & Purchasing Agent, Steel Products Fabricators, 12032 S. Emerald Av.

134-83 Charles M. Sather, Mechanical Designer, Mid-Continent Medal Prod., 1960 N. Clybourn Av.

135-83 A. B. Fisher, Jr., Operating Manager, Freyn Engineering Department of Koppers Co., Inc., 109 N. Wabash Av.

136-83 Richard Iversen, Specification Engr. (Switchboard), Western Electric Co., Hawthorne Works.

137-83 Charles R. Parker, Division Plant Supervisor, Illinois Bell Telephone Co., 6317 S. Maryland Av.

138-83 Owen R. Rice, Vice President, Freyn Engineering Department, Koppers, Co., Inc., 109 N. Wabash Av.

Crerar Library

Notes and News

A review of Crerar history discloses some interesting facts about the association of several board members with railroads. John Crerar spent 27 years in the railroad supply business, principally with the firm of Crerar, Adams & Company. He also had direct affiliation with railroads. Shortly after coming to Chicago he became a director of the Chicago & Alton Railroad. He was also a director, and for a time president, of the Chicago & Joliet Railroad. And in 1867, he was one of the incorporators of the Pullman Palace Car Company, and served on the board of directors until his death.

This close association with the growing railroad industry explains the selection, by Mr. Crerar, of three other railroad men to serve on the first board of directors of the Library. These were Timothy B. Blackstone, Robert Todd Lincoln and Albert Keep, all eminent contemporaries of John Crerar.

Timothy B. Blackstone entered railway service in the East in 1847. Moving west he was division engineer for the Illinois Central R. R. during its first five years (1851-55), followed by five years as chief engineer of the Chicago & Joliet R. R. of which John Crerar was later president. Mr. Blackstone was president of the Chicago & Alton R. R., an office he held for 35 years.

Robert Todd Lincoln was counsel for The Pullman Company. After the death of George M. Pullman, Mr. Lincoln became president of the company, resigning from the position in 1911. He served on the Crerar Board from 1894 until 1899.

Albert Keep (Crerar Board 1894-1907) was associated with the Chicago & North Western Railroad Company from 1873-1901, first as director, then as president, and finally as chairman of the board of directors. He also served as a director of the Lake Shore & Michigan Southern Railroad Company, 1865-1883.

Several later members of the Crerar Board have also been associated with railroads as directors or officers: Arthur J. Caton (Chicago & Southern Railroad Company); Marvin Hughitt (Chicago & Alton Railroad, Illinois Central Railroad, C. M. & St. Paul Railroad, and Chicago & Northwestern Railroad); Albert Sprague (Clearing District B & O Railroad Company); and Edward L. Ryerson (Atcheson, Topeka & Santa Fe Railroad).

(*Continued from Page 8*)

times require a more basic knowledge of refrigeration principles than the usual operator may possess, and it then becomes the responsibility of the refrigeration engineer to explain the cause or effect of the change to the operator. By means of accurate logs the refrigeration engineer can intelligently recommend changes to management which would increase the capacity of the system at nominal expense, provide means of cost comparison, and provide data from which freezing and storage costs may be computed. The refrigeration engineer should also establish maintenance logs on all refrigeration equipment. The maintenance log furnishes the operators, the refrigeration engineer and management with a history of each piece of equipment relative to the actual maintenance required for the specific item and the cost of such maintenance. By proper attention to location and use of thermometers and gauges, by keeping an accurate and active operating log, and by the use of maintenance logs the refrigeration engineer has all the information required to answer questions of management and operators.

The refrigeration engineer can well be proud of his contribution to the frozen foods industry. By working closely with the chemists, the bacteriologists, and the food technologists, he has helped an industry which started as an infant in 1934 to increase its size by 1,280 per cent in 14 years. His position in the food industry is secure and ever expanding and no one can predict how much the industry will grow. By using the basic theory of heat transfer, fluid flow, thermodynamics and psychrometry the refrigeration engineer is "bridging-the-gap" between fundamentals and practice for management and operators. The refrigeration engineer in the frozen food industry is best qualified to advise management in expenditures of funds for refrigeration equipment, and operators in technical problems relating to maximum efficiency and economy of operation.

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Reviews of Technical Books

Available at WSE Headquarters

Heat Transfer

Introduction To Heat Transfer, by Aubrey S. Brown and Salvatore M. Marco, McGraw-Hill Book Company, Inc., New York, N.Y. Second Edition 1951. 267 pages. $4.50.

This book provides an introduction to the subject of heat transfer suitable for use as an undergraduate textbook and as an aid to engineers in practice. It presents the subject in a manner that is readily understandable to engineering students. Emphasis is on fundamental principles and the development of the most common mathematical expressions applied to calculations of heat transfer. The use of complicated mathematics is kept at a minimum.

Outstanding new features include material on estimating heat conduction by the mapping method, characteristics of insulation, calculation of solar radiation, fluid flow, and so on.

The book has a 22 page appendix of charts and tables, and is liberally indexed.

H.P.H., W.S.E.

Illuminating Engineering

Light, Photometry, and Illuminating Engineering, by William E. Barrows, McGraw-Hill Book Company, Inc., New York, N.Y. Third Edition 1951. 415 pages. $7.50.

This book accomplishes the difficult task of condensing the rapidly accumulating literature on the advances in the field of light and illumination and is designed as a text for students of illuminating engineering and as a reference work for the practicing engineer. It presents accepted principles and modern practice in illuminating engineering and aids in the selection of lighting equipment.

Material is offered on vision and photometric measurements, illumination levels, various types of lamps, utilization factors of luminaries and design data, together with the method of procedure in applying this material to the design of lighting installations in homes, shops, streets, and airways.

It is liberally illustrated and well indexed.

H.P.H., W.S.E.

Engineering Graphics

Engineering Graphics, by John T. Rule and Earle F. Watts, McGraw-Hill Book Company, Inc., New York, N.Y. 298 pages. $3.75.

This excellent book is a new approach to the study of engineering drawing. It is a thorough treatment of graphical processes, in contrast to the usual algebraic solution of engineering problems.

Graphical analysis, the authors maintain, frees the student from absolute dependence on his ability to make working drawings. Graphical methods, moreover, are claimed to be just as accurate as algebraic methods so long as its accuracy is held well within the accuracy of the original data.

This is the first book to treat the field of graphics as a tool of importance to the engineer. A wide range of problems is included in the text, and these are worked out in detail in the manner in which they should be mastered.

J.C.L., W.S.E.

Fluid Flow

Thermodynamics of Fluid Flow, Newman A. Hall. Prentice-Hall, Inc., New York, N. Y. 1951. 278 pages. $7.35.

This text is an introduction to the combination of two of the major basic techniques of analysis of fluid mechanics and thermo-dynamics. It assumes that the reader is well-grounded in the fundamentals of both of these basic techniques and mathematics. Problems of fluid flow are given with the method of applying the theory stated, with references to handbooks for more complete information. All flows are considered steady and of one dimension.

The thermodynamics of the flow of liquids and imperfect gases is considered; also losses such as wall friction and turbulent separation.

The text closes with chapters on Diabatic Flow, Propulsion Systems and several useful tables.

W.C.M., W.S.E.

Photographic Surveying

Practical Photogrammetry, by H. Oakley Sharp. The Macmillan Company, New York, 1951. 229 pages, $3.75.

Knowing the dollar and cents value of photographic surveying to the modern engineer, the author of this book gives engineers a fine instruction manual on the subject of photogrammetry.

Fundamental theories used in both terrestrial and aerial photographic surveying are thoroughly covered. Also included are important practical applications, such as flight maps for planning purposes, land surveying, tax maps, highway surveying, soil studies and specifications for photographic surveys.

Certain practical suggestions are also made as to the use and cost of different types of projects.

Detailed descriptions for the use of a stereoscope—the most important piece of equipment used by the photogrammetrist—form an important part of this book.

General knowledge of this subject is of such economic importance to engineers that this book must be highly recommended as essential reading.

J.C.L., W.S.E.

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Obituaries

Reuben F. Peterson, a member of WSE since 1948, died recently. A graduate of Iowa State College, Mr. Peterson was an engineer with the Illinois Bell Telephone Company. With the exception of two years in the Army, Mr. Peterson had been with Illinois Bell since 1930.

Edwin C. Knuth, a life member of WSE, died in late November. Owner of E. C. Knuth & Co., General Contractors and Civil Engineers of Milwaukee, Wis., he had been a member of WSE since 1919. Well-known as a professional engineer, designer and general contractor, Mr. Knuth was made a life member of the Society last year. On this occasion, he donated $25 to WSE to be used for the building fund or any other activity in need of funds.

D. E. Wageck, member of WSE, died in mid-October. An assistant manager of industrial sales at the Public Service Company of Northern Illinois, Mr. Wageck had been associated with that company in various engineering capacities since 1927.

Hugh E. Young, life member of WSE died November 28. Mr. Young's last position was that of Engineer of Design for Ralph H. Burke, Construction Engineers at Bensenville, Ill. A member of the Society since 1919, he served as Trustee from 1941-1944 and as a member of the Washington Award Commission during the same period of time.

Edward N. Strait, electrical engineer, and pioneer in public utility regulation, died December 23. A life member of WSE, Mr. Strait was for 34 years manager of the Rate Research Department of the Pioneer Engineering Co., retiring in May, 1950. He served the Wisconsin Railroad Commission as rate and valuation engineer from 1907 to 1916, being chief statistician upon leaving.

He was a member of the Illuminating Engineering Society. During World War II he was on loan to the War Production Board. He was past chairman and for many years a member of the Rate Committees of the Edison Electric Institute and the American Gas Association.

Loran D. Gayton, member of WSE from 1910 to 1940, died suddenly December 29. An assistant engineer and an employee of the City of Chicago for nearly 40 years, Mr. Gayton entered the bureau of engineering in 1913. He was named city engineer in 1927 and served in that post or as acting chief engineer until 1941. He played an important role in the design and construction of the city's filtration plants.

In 1939, Mr. Gayton served on the Executive Committee of WSE and was a member of the Traffic Engineering and City Planning Section.

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New York Chicago Detroit San Francisco

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These items are from information furnished by the Engineering Societies Personnel Service, Inc., Chicago. This SERVICE, operated on a co-operative, non-profit basis, is sponsored by the Western Society of Engineers and the national societies of Civil, Electrical, Mechanical and Mining and Metallurgical Engineers. Apply to ESPS, Chicago and the key number indicated. Prepared ENGINEERS AVAILABLE advertisements limited to 40 words, with typed resume attached may be submitted to ESPS Chicago by members of Western Society of Engineers at no charge.

POSITIONS AVAILABLE

ESTIMATOR, JR., Grad. M.E. One year experience preferably in drawing room. Knowledge of shop operations. Duties: Reading blue prints and able to visualize parts, required knowledge of materials and sources of supply prepare bills of material and assist in preparing estimates for manufacturer of heavy medium metal products. Salary: $360. Location: Chicago. R-8507.

INDUSTRIAL TRAINEE. College degree preferred with major in labor and industrial relations or personnel administration. Will assist in general industrial relations program. Salary: $80.00 week. Location: Chicago agea. R-8508.

DESIGNERS AND DRAFTSMEN. Two years experience struct. mech. and electrical. Knowledge: Processing and chemical plant layout. Duties: On Board laying out oil refineries, power and chemical plants. Salary: $1.75 to $3.50 hour. Location: Chicago. R-8509.

RECENT GRAD., C.E. Age: up to 30. Recent graduate or better. Knowledge: Sanitation on highway. Duties: Design and field work for consulting. Company will negotiate fee. Salary: $350-$400 month. Location: Western Chicago Suburb. R-8510.

MASTER MECHANIC. Education: Grad. desired. Age: to 50. Duties: Directing tool making and design and maintenance, machine repair, buildings and grounds. Supervise about 800. Principal emphasis is on tooling and machine repair. For manufacturer of refrigerators. Salary: up to $15,000. Location: Ohio. R-8511.

CH. INDUSTRIAL ENG., I.E. or M.E. grad. pref. Age: up to 50. Duties: Covering whole scope of industrial engineering. Will supervise about 100 people in a plant of 5000. Should have broad experience including supervision. Manufacturer of refrigerators. Salary: to $15,000. Location: Ohio. R-8512.

RECENT GRADUATE. Knowledge: Math. and drafting. Duties: Assisting Chief of Party on construction survey for R.R. Company may negotiate the fee. Salary: $296 month. Location: Calumet district. R-8513.

TOOL AND DIE DESIGNER. Age: to 45. Knowledge: Sheet metal and deep drawing helpful. Duties: Tool and die design work for a manufacturer of air conditioning. Company will pay moving expenses and the fee. Salary: $400 to $450. Loc.: Wisconsin. T-8514(a).

TOOL ENGINEER, M.E. Age: to 45. 2 or more years experience in tool and die tryout and checking. Knowledge: Sheet metal fabrication. Duties: 30% time on the board assisting tool and die designers and 70% time in tryout and follow-up. Company will pay moving expenses and the fee. Salary: $500 month. Location: Wisconsin. T-8514(b).

METHODS ENGINEER. Age: to 45. 2 or more years experience in sheet metal methods or processing. Knowledge: Sheet metal fabrication. Duties: Project or area methods, processing, and writing process sheets. Company will pay moving expenses and fee. Salary: $400-$450 month. Location: Wisconsin. T-8514(c).

SALES, C.E. or Arch. Age: to 35. Recent graduate or better. Knowledge: Blue prints and construction drawings. Duties: Selling metal building materials to industrials, architects, and engineers. Will help on fee. Salary: $100 a week. Location: Chicago. Short trips. Car required. R-8515.

DESIGNER-ESTIMATOR, M.E. Age: 28-50. 2 plus years experience designing pressure vessels to A.S.M.E. Code. Knowledge of design and estimating. Duties: Design, estimating and partial supervision of sheet metal fabrication of pressure vessels. Company will help on fee. Salary: up to $9,000. Location: Chicago. R-8516.

RECENT GRADUATE, MECH. None to 2 years experience. Duties: All board work on designing and drafting on screw and related machinery. Salary: $325-$400. Location: Chicago. Will negotiate fee. R-8526.

If placed in a position as a result of an Engineers Available or Position Available advertisement, applicants agree to pay the established placement fee. These rates are available on request and are sufficient to maintain an effective non-profit personnel service. A weekly bulletin of positions open is available to subscribers. Apply ESPS Chicago.

ENGINEERS AVAILABLE

INDUSTRIAL ENGINEER. Ind. Mgmt. 27. Two yrs. and three mos. ind. eng. designing conveyors, est. standards and incentive system, methods, cost est. gov't quotations, procedures, inventory control, cost estimates, standard number system. Twenty-seven mos. T.S. Engr. est. standards, standard data, methods, graphs on performance, blueprints. $6000. Midwest. 260-MW.

DISTRIBUTION ENGINEER. E.E. 42. Four yrs. Elec. Eng. responsible for electrical and mechanical design of electric power, light heat ventilation, water distribution, water and sewer plants, major electrical equip. installations, electrical controls for production lines. Seven and one half yrs. electrical design of components as related to steel mill constr., switchboard design, control circuit design, complete design of facilities for A.C. and D.C. distribution substations. $8000. Chicago. 261-MW.

DISTRIBUTION ENGINEER. E.E. 28. Seven yrs. electrical design engr. light and power circuit analysis and design for industrial buildings, power plant design, material and cost estimates, electrical specs. writing, motor control design. One yr. design of construction of power plants. $6000. Midwest. 262-MW.

FIELD ENGINEER. C.E. 27. Twenty one mos. inspector to inspect the quantity and quality of materials used in the construction of a bay bridge. Nine mos. bridge draftsman design and detail of R.R. bridge repair. $5000. Midwest. 263-MW.

CONST. SUP'T. C.E. 30. Three yrs. construction superintendent and field engr. for contractor on any job that comes up, handle an average of 12 employees and jobs from $20,000 to $180,000. Salary: $6300. Midwest. 264-MW.

STATISTICAL RESEARCH. Ph.D. 74. Ten yrs. lecturer in math., regular teacher of college math., statistical research and surveys. $450 mo. Chicago. 271-MW.

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MODERN WATER STORAGE AT MADISON

The City of Madison, Wisconsin installed the 3,000,000-gal. welded steel standpipe, shown at the left, in its water distribution system. The tank is 73 ft. in diam., 100 ft. to the high water line, and has eight semi-cylindrical pilasters welded to the outside of the shell at equi-distant points and extending up over the self-supporting ellipsoidal roof to an ornamental cupola at the top.

The water distribution system in Madison consists of 2 mi. of transmission mains from 8 to 30 in. diam. and 240 mi. of 3 to 30 in. diam. distribution mains. It serves approximately 20,000 customers, over 95 per cent of which are domestic users, and 2,000 fire hydrants. Total consumption ranges from 10 to 18 mgd. and averages 12 mgd. The City of Madison obtains its water supply from 12 deep wells.

Write our nearest office for complete information of quotations on steel reservoirs or elevated steel tanks.

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These steel structures are good examples of Allied's versatility in meeting today's specialized building needs. Here specialized skill of workers in the plants "pays off" in steel for a river bridge, industrial and educational buildings . . . the mass tonnage fabricated to exact specifications and delivered on schedule.

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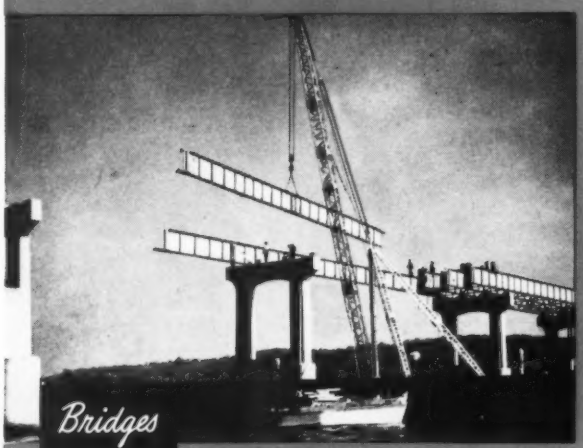
Offers, too, cost-saving advantages interesting to those who contemplate building. Send your plans and specifications to us for estimating.

School Buildings

Crews moved "super-fast" to fabricate and deliver steel on schedule for the Hinsdale, Ill., school.



Bridges

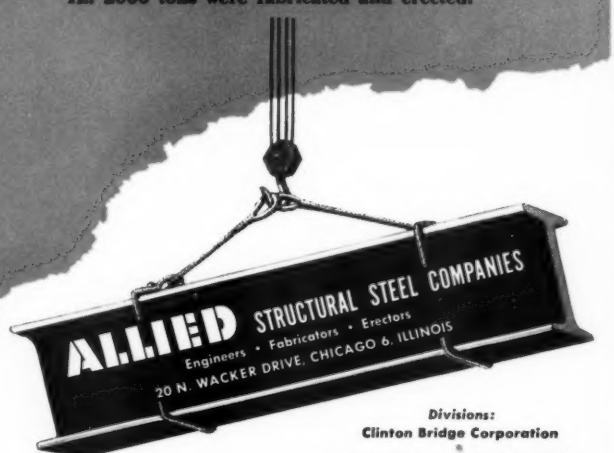
5000 Tons of steel were erected by Allied for this huge bridge at Peoria, Illinois.

Industrial Buildings

Casting plant of Aluminum Co. of America, Hillside, Ill. 2000 tons were fabricated and erected.

Air Line Pilots Headquarters

Allied's 3 plants, operating as one fabricator, turned out steel for this Chicago Air Line Pilot's Administration Building.



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